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Carla K. Smink
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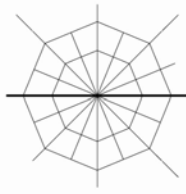

Technology, Environment and Society

Department of Development and Planning
Aalborg University

Colophon

Coherence in process- and product-oriented environmental policies in the car industry – cases of BMW and GM

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Abstract

The car industry currently faces increasing regulatory pressure to improve both its methods in production and the sustainability of its products.

Many car manufacturers have adopted proactive environmental strategies and it is common practice to implement an Environmental Management System (EMS) at production facilities. However, the car has an impact on the environment at each stage in its life cycle. The car is considered to be one of the most polluting consumer products.

This article investigates how the car industry has dealt with both process-oriented and product-oriented environmental policies and to what extent these two policy concepts have been integrated.

We have conducted case studies of BMW and GM with interviews at the headquarters of the parent companies and with production plants in South Africa to analyse how they attempt to integrate process- and product-oriented strategies.

Key words: car industry, process-oriented policy, product-oriented policy, BMW, General Motors (GM).

Coherence in process- and product-oriented environmental policies in the car industry – cases of BMW and GM

Carla K. Smink, Tine H. Jørgensen & Eskild Holm Nielsen

Introduction

In the European Union (EU), the number of car has trebled during the last 30 years and is rising by 3 millions a year (European Commission, 2001). With this increase in car ownership people have become more mobile, which has led to an increase in commuting. In Denmark for example, the average adult travels 35,5 kilometres a day, and commuting accounts for 30% of this, while the remaining transport is for leisure activities, shopping and other activities (Danish Transport Council, 2000). In the White Paper on European Transport Policy (2001) it is expected that economic growth will bring more mobility, and passenger transport is expected to increase with 24% (European Commission, 2001). An increase in the number of cars can also be seen in OECD-countries. The total number of cars in OECD countries is expected to grow by 32% (period 1997-2020) and, on a global scale, with 74% in the same time period (Wengel et al., 2003). Not only is the number of cars increasing, also the number of car-kilometres has increased.

Transportation is vital for modern lifestyle. From an environmental point of view, transportation uses a significant amount of non-renewable resources. In Europe, the transport sector is one of the most polluting sectors in terms of carbon dioxide (CO_2) emissions (EEA, 2002). A WHO study shows that health effects of transport-related air pollution in urban areas have increased substantially, and it is estimated that more than ten thousands people in the EU die each year because of transport related air pollution.

In the European context, road transportation is the most dominant polluter in the transport sector, even though cars have become more effective in terms of CO_2 emissions. The average specific CO_2 emissions of new cars fell 7.5% from 186g CO_2/vehicle-km in 1995 to 172 g CO_2/vehicle-km in 2000 (EEA, 2002).

Understandably, if emissions are not reduced the current and the expected increase in the number of vehicles on the roads will have a huge impact on aspects such as human health and global warming. The severity of this impact is evident when a developing nation like China is compared with the United States. In the 1996, China had 23 cars per 1000 inhabitants (Factbook, 2005a), whereas the United States had 787 cars per 1000 inhabitants (Factbook, 2005b). It might be clear that an economic growth in China and other developing countries – with the concurrent increase in car density – additional air emissions will have a major impact on the global environment.

Car use exerts pressures on the environment in many ways. Cars are a significant contributor to deteriorated air quality, climatic change, human health effects, noise, congestion, accident deaths and injuries. In response to this, cars have become more efficient, cleaner, safer and more recyclable. Over the years, major achievements have been realised (e.g. catalytic converters, improved energy-efficiency etc.), which have resulted in a reduction of the environmental impacts of the car. However, increase in the number of cars and the expanded use of cars – among other things – have cancelled out these achievements.

Within a car's life cycle, car use makes the greatest impact on the environment. Therefore, product development often focuses - among other things - on reducing climate-relevant emissions during car use. The remaining environmental impacts are shared by production and disposal or recycling.

In this article the coherence between process-oriented and product-oriented environmental policies in the car industry will be investigated. The theoretical point of departure is a discussion of two theories on process- and product-oriented environmental strategies. In order to analyse how the car industry can implement environmental policies that are aimed at stimulating innovation and market creation for 'green' cars, we will make use of the theory of ecological modernisation. Empirically, we will analyse to what extent process- and product-oriented environmental policies have been integrated in the corporate environmental policy of BMW and General Motors (GM) and to what extent these policies have been implemented at their production facilities in South Africa. In the conclusion the responses of BMW and GM to process- and product- oriented environmental regulation are discussed further in a broader context.

Empirically, this article is based on interviews with the environmental managers of BMW and Opel in Germany and the environmental managers of BMW’s and GM’s production facilities in South Africa. We have also conducted a literature review of BMW’s and GM’s sustainability reports.

Process-oriented and product-oriented environmental strategies

Traditionally, the focus of environmental regulation was on single companies that, often individually, developed solutions to meet the emission standards set by the government (Keijzers, 2000). This so-called process-oriented strategy is illustrated in figure 1.

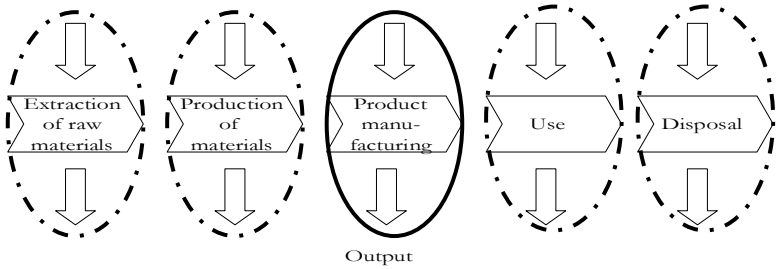


Figure 1. Schematic illustration of the process-oriented strategy.

As figure 1 illustrates, regulation is aimed at the production process of single stages of the life cycle of a product. The manufacturing phase is highlighted in order to illustrate that this is the most regulated phase.

This regulatory approach has predominantly focused on reducing resource usage and emissions from the production process. One of the main strengths of this approach was that it was relatively easy to 'go for the easy gains' - as environmental improvements and economic savings could be achieved via technical optimisation and changes to work routines (Remmen, 2003). This strategy can be considered a story of success. It has contributed to a reduction of environmental pollution so that some of the most visible environmental problems such as air and water quality have improved recognisably, smog levels were reduced dramatically, and the visible pollution of surface waters disappeared (Keijzers, 2000). However, a major weakness of this strategy is that environmental efforts are addressed to single production sites and therefore possibilities for environmental improvements are limited. Besides, these process-based controls may in some contexts be approaching their technological and economic limits. The environmental or health benefits gained through further reductions in emissions may, in some cases, not be proportionate to the costs (Berkhout, 1998).

Since the mid-1980s, the discourse on pollution prevention has changed *from* cleaner production processes *over* environmental management *to* cleaner products (Remmen, 2001). Remmen (2003: 8) illustrates this development as an inverted pyramid, see figure 2.

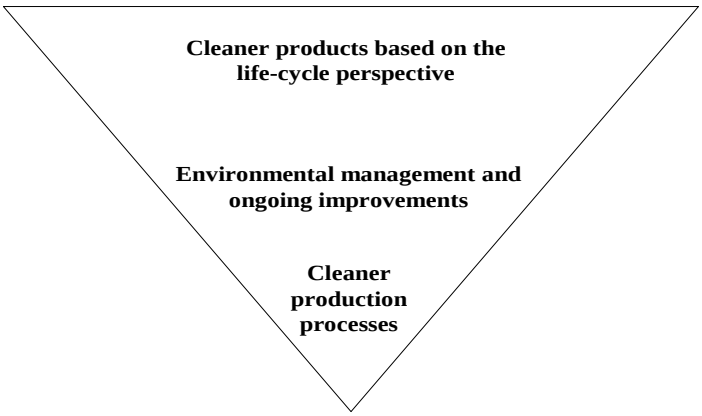


Figure 2. The inverted prevention pyramid (Remmen, 2003: 8).

Since 1992, the focus for preventive environmental initiatives has increasingly been environmental management in the form of either simple models for environmental management or certified/registered environmental management systems in respect to ISO 14001 or EMAS (Remmen, 2003). The focus has thus potentially shifted from techniques to organisation, from technical process optimisation to a company's organisational prerequisites for systematic, continual, and preventive environmental initiatives (Remmen, 2003).

Since the mid-1990s, focus on cleaner products based on the life cycle perspective has increased. In product development, a Life Cycle Assessment (LCA) can be used to determine all relevant environmental impacts throughout a product's entire life cycle: from production through use and service to recycling. Obviously, the production process has to be optimised in terms of the environment in order to develop cleaner products. In other words, a product-oriented environmental strategy can not be put into practice without having implemented a process-oriented strategy.

The shift from cleaner production to cleaner products can be summarised as follows (see table 1)

Concept	Focus of innovation	Incentives
Cleaner production	Technical optimisation Good housekeeping	Eco-efficiency Resource savings
Environmental Management	Organisational Collaboration within the trade	Image Diffusion and dissemination
Cleaner products	Product improvements Product chain/stakeholders	Competitive advantage Credibility

Table 1 Overall changes in the cleaner technology concept (Remmen, 2001: 60)

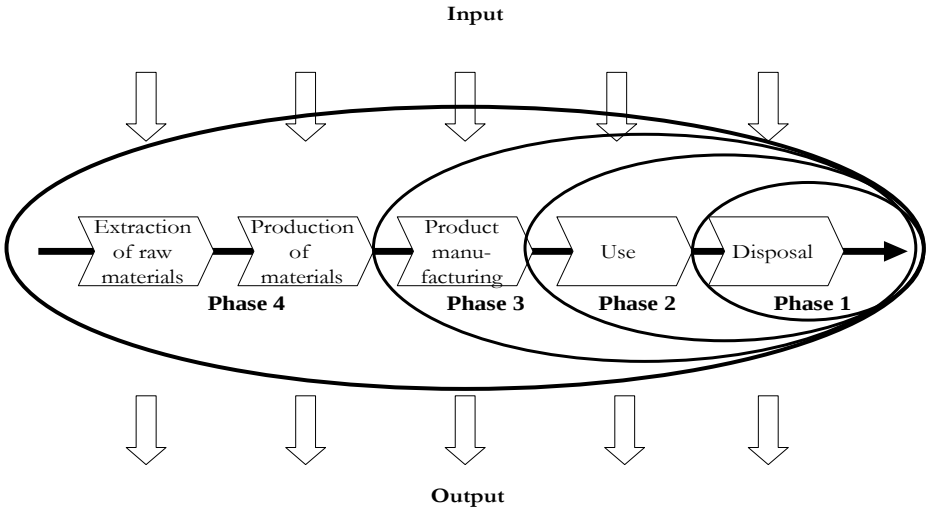
Adjustments of environmental regulation

As mentioned above, in a product-oriented strategy focus is on the reduction of the environmental impact of products. However, implementation of a product-oriented policy involves overcoming a range of obstacles and might – as argued below – consist of different phases before, strictly speaking, we can talk about product-oriented policy. For example, many product systems are global in scope, which means that environmental impacts cross national borders. In the second place, there are many different actors involved in the production and consumption of products. This means that the definition of responsibility for environmental impacts along a product system is fragmented, overlapping and shifting (Berkhout and Smith, 1999). The car industry is an example of a global industry in which many different actors are involved and production units are placed all over the globe. With this, the car industry is among the most complicated industries to implement product-oriented policies.

A product-oriented policy cannot be implemented the same way as a process-oriented policy. Berkhout and Smith (1999) state that a product policy changes the focus, extends the scope and alters the means available to environmental policy. This also means that (Berkhout and Smith, 1999: 177):

- A wider network of partnerships between national and international stakeholders must be created, with new rights and responsibilities allocated to public authorities, producers and consumers;
- The policy process needs to become more transparent, open, interactive and co-operative, placing greater stress on voluntary actions and market instruments, with public authorities taking the role more of facilitators and arbitrators, rather than merely enforcers of rules laid down in legislation.

Figure 3 illustrates the product-oriented strategy.



Phase	Environmental policy
1	Policies for managing visible product-related wastes
2	Policies that aim to generate and make accessible environmental information about product systems (e.g. eco-labels) to producers and consumers
3	Policies specifically aimed at stimulating innovation and market creation for green products are introduced
4	Product policy may operate across the whole life cycle of products

Figure 3. Illustration of the product-oriented strategy (adapted to Berkhout and Smith, 1999).

Ecological modernisation and the car industry

In order to analyse how the car industry can implement environmental policies that are aimed at stimulating innovation and market creation for 'green' cars, we will make use of the theory of ecological modernisation.

Ecological modernisation theory is concerned with how contemporary industrialised societies deal with the environmental crisis. It posits that environmental reform of the modern organisation of production and consumption can shape a path towards sustainable development, based on the idea that collaboration among key actors, such as government and industry, can generate win-win outcomes of economic development and environmental improvement (Mol and Sonnenfeld, 2000). So far, a variety of policy instruments are deployed to integrate the environmental dimension in economic decision-making (e.g. economic instruments). Many of these instruments have been in use for quite some time now, but there is little integration between these instruments. One of the main consequences of a product-oriented policy is that it is hard to find examples of product-oriented *strategies*. So far, focus has been mainly on product-oriented *initiatives*. That is, isolated activities that have not been integrated in one corporate product-oriented environmental strategy.

The environmental challenges for the car sector can only be addressed properly by applying both a process- and product-oriented environmental strategy. Until the appearance of ecological modernisation environmental improvements were driven by economic and regulatory factors. In order to get a sound picture of the car industries context we will briefly describe the environmental regulation within this sector.

The car industry: Environmental regulations

In the last half-century the car has been regulated by safety, emission and environmental regulations. Table 2 gives a more detailed overview of several phases in the history of primary environmental regulatory concerns in the car industry.

Year	Environmental regulatory concerns
1950s	Air quality
1960-1970s	Tailpipe emissions
1980s	Evaporative emissions
1990s-2000s	Carbon dioxide Sustainable development
2000s	Sustainability
2010s	Closed-loop economy

Table 2. History of primary environmental regulatory concerns (based on Nieuwenhuis and Wells, 2003: 130).

Environmental regulation from the government was, is and will be important to the car industry. There are a large variety of environmental instruments directly aimed at the car industry. Often, these regulations are aimed at single production phases of a car: raw materials extracting and processing phase, manufacturing phase, in-use phase and the dismantling phase. Table 3 gives a schematic overview of different environmental instruments that regulate the car industry.

Raw materials extracting and processing	Manufacturing	Use	Dismantling
Taxes on the use of virgin materials Recycled materials quotas	Taxes on the use of virgin materials Emission standards Safety regulations	Speed limits Car care products Fuel price Environmental standards service stations	Recycling quotas Recycling partnerships Recycling programmes

Table 3. Examples of environmental instruments that regulate the production process of a car. (Adapted from Mildenberger and Khare, 2000).

Many of these instruments are developed in a national context, but they have a global impact. These national standards are largely defined in the public arena. As we will see below, global process standards are increasingly being formulated by private initiatives. The growing influence of global standards in global markets is likely to weaken the national standards. This is because national standards must increasingly comply with international norms (Nadvi and Wältring, 2002).
Next to these regulations that are specifically aimed at the car industry, car manufacturers have also been affected by several general regulations concerning manufacturing a car such as water, air and waste regulations. Due to new EU water regulations (Directive 2000/60/EC), for example, car manufacturers have to replace some substances used in car manufacturing e.g. chlorinealcanes used as lubricants in metal processing (Wengel et al., 2003). Also with regard to waste regulations, the car industry is heavily regulated, e.g. regulation on the landfill of waste. The car industry is one of the biggest users of landfill, as approximately 25% of a car's weight, the Auto Shredder Residue (ASR), is hazardous waste containing plastics, rubber, glass, textile, paint etc. which is landfilled. ASR was one of the most important reasons for Community legislation on end-of-life vehicles. Other waste regulations that are not specifically aimed at the car industry are the strategy on the prevention and recycling of waste and the Integrated Pollution Prevention and Control (IPPC) Directive.

Corporate responses to environmental regulation

Ecological modernisation theory states that market forces and public environmental regulations (e.g. incentives, subsidies and sanctions) are among the main driving forces for companies to improve their environmental performance. In other words, companies develop more sustainable products and processes in response to external stimuli.

As a global player, car manufactures have played a role in the ecological modernisation of environmental policy. The car manufacturers have acknowledged their responsibility in the World Business Council for Sustainable Development (WBCSD). Car manufacturers are involved in this coalition of 150 international companies united by a shared commitment to sustainable development (UNEP, 2002).

To a large extent, car manufactures have created many product-oriented initiatives mainly as corporate strategies. On a global scale, there are still enormous environmental challenges in life cycle perspective. At the United Nations' World Summit on Sustainable Development in Johannesburg in 2002, the business society played a new role trying to put their agenda forward. At the World Summit BMW, for example, presented their sustainability strategy, which is not only about the company's obligations as a part of society, but also their social standards for employees as well as its commitment to environmentally-friendly production, company products, and traffic in general. The interplay of a corporate strategy and environmental responsibility has only recently begun to be considered (Ledgerwood et al., 1992).

In figure 3 the product-oriented strategy was illustrated. One of the main points in this figure is that implementation of a product-oriented strategy will develop along four phases. It is important to add that before we, strictly speaking, can talk about a product-oriented strategy, these phases should be integrated including the instruments used in each of the four phases. In table 4, various product-oriented instruments are presented. It is important to stress that the table is a schematic way of illustrating different regulatory instruments. An instrument used in one phase often has an impact within the whole product chain.

Development	Production	Use	Recovery
Design for Recycling (DfR) Fuel efficiency programmes Design for the Environment (DfE) Design for Disassembly (DfD)	Use of recycled materials	Dealership waste management Spare parts	Market-based ELV-recovery Dismantling manuals

Table 4. Examples of product-oriented initiatives

In general, it can be stated that the instruments in table 4 form a kind of a toolbox from which the car industry selects the tools in order to improve the environmental impact of a car. Even though car manufacturers select all instruments, there is generally little integration between the instruments from the different phases. One of the reasons can be the fact that the car chain consists of two more or less independent networks, a production network and a use-, recycling and disposal network. In Smink (2002) it is described that there is hardly any contact between actors in these two networks. This makes it difficult to implement product-oriented environmental policies in the car chain, as the implementation of product-oriented policies is based on an increasing collaboration between state actors and non-state actors (mainly industry, but sometimes supplemented by environmental NGOs). Consequently, the car industry faces enormous challenges to go beyond phase 1 and 2, as illustrated in figure 3. Another concrete example can be taken from GM. Since 2001, GM has posted its vehicle recycling information manuals on its web site. These ELV-manuals provide car dismantlers with information about which parts of a vehicle that can be recycled. The question is whether this ensures that all car-dismantling companies will read and use these manuals. An interview with a Dutch car dismantling company showed that such a dismantling manual is not always properly introduced (e.g. only in English - a language many car-dismantlers do not read or speak, sending a CD-ROM with dismantling information by mail without introduction) to the car-dismantling companies and, consequently, car dismantling companies will not use the manuals (Smink, 2002). Besides, if there is no feedback from the car-dismantling companies to the

car manufacturers, possible recommendations for improvements in the dismantling manuals (environmental instrument in the recovery phase) will most likely not lead to adjustments in, for example, the recycling oriented design like Design for Recycling (DfR), which is an environmental instrument in the development phase.

Case studies of BMW and GM - the development of a global environmental strategy

In this section we will analyse how and to what extent BMW and General Motors (GM) have implemented process-oriented policies and supplemented these policies with product-oriented policies. First, we will look at the corporate environmental strategy of both companies and the overall policies for process and product-orientation. Afterwards we will compare to what extent their corporate environmental strategies are applied at their production facilities in South Africa and how their process-oriented policies work in practise. Finally, we compare the findings of the two case studies. It is our hypothesis that both BMW and GM – in theory – have a product-oriented policy, but that in practice both companies mainly work with process-oriented strategies and some product-oriented initiatives.

BMW: Environmental strategy of the parent company
In the Sustainable Value Report 2005/2006 (BMW, 2005: 4), Helmut Panke – chairman of the Board of Management of BMW – states: *'In terms of sustainability, a company is particularly credible and effective when it takes responsibility for its products throughout their entire life cycle - from production through the long phase of use to end-of-life recycling. It is only here, in its own sphere of influence, that the responsibility practised in a company can really change something permanently (…)'*

This statement clearly states that BMW sees a product-oriented strategy as a necessary step towards sustainability. In this section, we will analyse to what extent BMW actually has implemented a product-oriented strategy. However, we will first analyse BMW's process-oriented policy, as - as stated above - a product-oriented environmental strategy can not be put into practice without having implemented a process-oriented strategy.

In their process-oriented policy, BMW focuses on implementing Environmental Management. Diffusion of EMS and image are among the most important incentives for implementing EMS. BMW has implemented EMSs at all their production facilities around the world. One of the reasons for BMW for doing this was to provide an integrated approach to address the environmental impacts of their activities. Implementing EMSs has contributed to a reduction of environmental impacts from production, see table 5.

	1998	1999	2000	2001	2002
Energy consumption (MWh/Unit)	3.56	3.42	3.16	3.08	3.21
Production process water input (m^3/Unit)	3.87	3.51	2.97	2.52	2.10
Production process wastewater (m^3/Unit)	1.23	1.15	1.06	1.07	0.92
CO_2 (t/Unit)	1.14	1.10	1.04	0.99	0.98
Waste (kg/Unit)	367	368	349	354	291

Table 5. BMW Group key figures: environment (BMW, 2003).

Furthermore, BMW promotes the diffusion of EMS along the product chain by demanding most of their suppliers of their production facilities to be certified according to ISO 14001 or EMAS. One of the major reasons for this is that BMW had recognised that suppliers collectively bring more than 70% of the value of each car to the line, and the supply chain failure impacts directly on the reputation of BMW. Today, 90% of their suppliers have an ISO 14001 certification or an EMAS registration (BMW, 2003) (see figure 4). Furthermore, BMW communicates the results of its EMSs to their surrounding communities and their customers in a meaningful and personal manner in order to benefit the company as a whole.

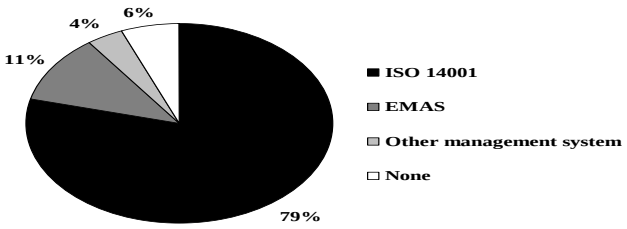


Figure 4. Environmental management systems at series suppliers of the BMW Group (BMW, 2003: 56).

At the corporate level, BMW has a number of environmental programmes, which can be labelled product-oriented initiatives. Examples are programmes on Design for Recycling (DfR), mobility, Design for the Environment (DfE) and Design for Disassembly (DfD). All these programmes are placed in the Research and Development division. The different environmental programmes are organised in a fragmented way. The activities are not yet incorporated in all divisions and all sites of the BMW Group. Different initiatives are taken at each production facility. For example, so far, DfR has only been an issue within the Research and Development division. Furthermore, BMW is working on a LCA. In a new series BMW, introduced in autumn 2004, steel has been replaced by aluminium. This means, unfortunately, that water consumption in the production phase will increase significantly.

This shows that LCA has 'not' functioned, as the EMS will not allow an increase in water consumption. The LCA is used as an analytical tool for specific development issues. So far, two persons in the development department and two in the waste department use LCA. If BMW wants to use LCA more strategically, it must be integrated in all divisions. So far BMW has no further plans for promoting LCA in the corporate strategy and specifically not in the development of new products. Therefore, these initiatives cannot be characterised as a product-oriented *strategy*.

Next, it will be analysed to what extent BMW's corporate strategy has been implemented at the South African production plant in Rosslyn.

BMW: Environmental strategy of the South African production facility in Rosslyn
The Rosslyn Plant was the BMW Group's first foreign location. At this plant more than 40,000 BMW 3 Series are produced a year, many of which are exported to the USA, Japan, Australia, Africa and the Middle East (BMW-web (2004a); BMW-web (2004b)).

In 1999, the Rosslyn plant received certification for its integrated management system for quality, work safety and environmental protection in compliance with ISO 9001, ISO 14001 and BS 8800 (BMW-web (2004a); BMW-web (2004b)). A requirement from their parent company was the main reason for the Rosslyn Plant to implement ISO 14001, but the environmental manager added that the demand from the parent company is also the demand from the customer.

At the Rosslyn Plant, the EMS has contributed to significant reductions of environmental impacts, risks and accidents. From 1998 to 2001, for instance, water and electricity consumption per manufactured vehicle was reduced by approx. 90% and 45%, respectively (BMW, 2002). These improvement rates are much higher than for the overall improvement figures for the whole BMW group (see table 5). The reason is probably that the Rosslyn Plant started implementing EMS and conducted environmental improvements some years later than most other BMW production facilities. During the first years with focus on environmental improvements, the Rosslyn Plant has been able to 'go for the easy gains'.

The environmental policies of the Rosslyn plant do not reflect the local South African context, but they reflect the environmental focus within the headquarters of the BMW Group. This illustrates what we have mentioned before: global standards in global markets are likely to weaken national standards. However, South African environmental regulation is complex in different ways. For example, the most difficult part of complying with ISO 14001 has been to determine which environmental legislation was relevant for the company. It took BMW a long time to gain an overview of the legislation to comply with, as BMW experienced that the South African law is very extensive and incomprehensive. Furthermore, BMW experiences that the enforcement of regulations in South Africa is

weak due to limited government resources. For instance, BMW has to contact the authorities themselves in order to ask for specific pollution permits and they must also take their own water samples; the authorities do not have the resources to initiate these activities. In other words, in a developing context, transnational companies must take responsibility for insufficient environmental governance if the emissions from their plants are to reflect modern environmental standards. Here, the demand from the parent company to implement ISO 14001 ensures that certified companies comply with regulations rather than being regulated locally (Smink, et al., 2006).

Diffusion of EMS along the product chain
In 2000, the Rosslyn Plant integrated a supply chain management programme into its EMS. BMW expected their suppliers to have a certified EMS according to ISO 14001 in order to improve the supplier's environmental performance and to maintain the integrated environmental compatibility of their processes. Most suppliers to the Rosslyn Plant are local suppliers, for example in the steel and plastic industries. The few overseas suppliers are mainly BMW's own component manufacturing plants. The latter group was already certified due to BMW's corporate environmental strategy.

The aim of the supply chain management programme was to provide key suppliers, which are a total of 48 suppliers, with support to help them adopt an EMS. In July 2002, 28 suppliers were certified according to ISO 14001. During this programme, BMW realised that aiming at an EMS for all suppliers was too high an ambition. A certified EMS was too complicated and too expensive for some of the small suppliers. Therefore, it was decided that small suppliers should be managed via Environmental Audits; as such, an audit was just as effective in ensuring that the environmental performance of certain suppliers are in line with their aims. When suppliers fail the audit, they will be excluded from the supplier group. The problem is, however, that some of the suppliers are the sole supplier for the entire industry in the country. 'So our hands are kind of tied if [our suppliers] are not performing, because they know we need them. (…) At the moment, the only stick BMW has to encourage these suppliers to improve their environmental performance is by giving a lower price for the product' as it was stated by BMW South Africa.

BMW has taken an initiative to establish a waste club including the major industries in the area in order to raise the environmental awareness and assist with knowledge about EMS and improvements of environmental performance. BMW is willing to share their knowledge because they do not want to be a company with high environmental performance while the neighbours still dump waste onto the road etc. The next step for BMW is to get a government representative and local environmental authorities to participate. BMW has taken a new role in relation to the local community. BMW has put their own resources into organising the waste group caused by lack of enforcement and resources from the environmental authorities.

GM: Environmental strategy of the parent company
In 1994, GM was among the first manufacturing companies to formally endorse the CERES Principles. It was seen as a step in affirming GM's commitment to environmentally responsible business activities. The original expectations of the involvement in CERES were continuous improvement in terms of public accountability and corporate disclosure, plant environmental performance and product performance. *'At GM, sustainability drives us to be systematic and proactive in seeking continuous improvement in our operations and products in a way that integrates economic, environmental and social objectives into our business decisions'* (GM, 2003). In relation to Sustainable Development, GM has been actively involved in the WCSD and has also participated at the 2002 World Summit in Johannesburg. GM's environmental policy and strategy have evolved in accordance with the degree of its involvement in such environmental fora.

GM is promoting resource conservation and pollution prevention among its suppliers and within its own manufacturing facilities and distribution systems. The company has a programme for recycling all non-hazardous materials in its plants and offices, as well as any used industrial oil and wastewater contaminated during the manufacturing process. Scrap from GM's manufacturing processes is re-used to produce vehicle parts (GM, 2004).

GM has a process-oriented strategy, as GM requires a certified EMS for all their manufacturing facilities and they also require their Tier-one suppliers to conform to ISO 14001 (GMSA, 2005a). With the advent of ISO 14001, GM redesigned the existing environmental management framework, which covers GM globally. GM benchmarks their facilities according to a number of environmental parameters. Their EMS includes several additional requirements that place increased emphasis on supporting environmental performance and cost reduction activities. These elements provide a global and common framework plus specification to help understand how individual plants interact with the environment, and to improve management of these plants in an ongoing cycle. GM has also adopted a number of programmes such as resource management and supply chain management. GM cannot be considered to have a product-oriented environmental strategy, but as for BMW they are working with recycling and product design.

GM: Environmental strategy of the South African assembly plants in Port Elizabeth
In 2004, GM bought Delta Motor Corporation (DMC) in Port Elizabeth, South Africa. DMC has two manufacturing plants in Port Elizabeth; the first manufactures the Opel Corsa and the Opel Astra, while the second plant manufactures Isuzu vehicles. DMC produces approx. 4,000 vehicles a month, which are exported to Zimbabwe, Zambia, Malawi, Mauritius, Mozambique and Kenya (GMSA, 2005a).

In 1997, DMC began to discuss possibilities for implementing ISO 14001. At that time, GM had a 49% shareholding in DMC. However, DMC's senior management was reluctant to implement an EMS because of the uncertainty regarding the return on investment. In

2000, when the environmental department moved from Human Resources to the Manufacturing Department, DMC started working on implementation of ISO 14001. By mid-2002, DMC had implemented an EMS according to ISO 14001. However, as by today - December 2005 - the system is not certified yet (GMSA, 2005b). One of the reasons why the system has not been certified might be financial.

DMC considers an EMS primarily as a condition for continuing as an agent on the export market in the future. In this regard, they are under increasing pressure to comply with the principles of GM. If GM fully realises their corporate strategy over the coming years, DMC will have to react to the parent company's demands on their suppliers. Already in 2002, GM conducted environmental audits at DMC and made a report highlighting a number of deficiencies that they wanted to address. In response, DMC formulated a number of environmental targets and improved their environmental performance. They have, for example, reduced spills considerably and implemented robotic spraying, which reduces the paint and solvents used. The Environmental Manager at DMC considers ISO 14001 as an instrument for solving the environmental challenges that GM highlights. All in all, however, the attitude of DMC towards environmental performance does not match the principles outlined by GM. Evidently, there is a gap between GM's corporate vision and the environmental practice at their production facility DMC.

Process- and product oriented policies at BMW and GM

Both BMW and GM have, as part of their corporate environmental strategies, implemented an EMS in all their production facilities world-wide. By this, BMW and GM are aiming at minimising pollution in the *production* of cars. By the implementation of an EMS focus is on organisational prerequisites for systematic, continual and preventive environmental initiatives. However, efforts to reduce environmental pollution are limited to a single phase of a product. Nevertheless, both BMW and GM consider an EMS as an effective way of handling environmental issues by dealing with environmental issues in a systematic manner and in an economically efficient way. Furthermore, it gives them assurance that their production facilities world-wide are in compliance with regulation. Both companies have a common framework for EMS, which has to be taken as a point of departure when EMS is implemented at the specific sites. BMW is in the process of developing a transnational environmental standard that reflect best environmental practice for the relevant environmental issues that must be applied in all corporate production units. So far, GM has adopted a common standard for a more limited amount of specific environmental issues. Environmental problems that are not covered by this standard will ideally be regulated by local environmental regulations. The implication is that the environmental objectives for BMW sites are more or less determined by headquarter, whereas GM has the objectives that the GM sites take both corporate as well as the local (national) environmental regulations as a point of departure.

Furthermore, both companies have integrated supply chain management in their EMS. GM has decided that all suppliers must have an ISO 14001 in order to continue as a supplier. BMW has required this from those suppliers that have the most significant environmental impacts. Integration of supply chain management in the EMS forces suppliers to establish an ISO 14001 system to ensure environmental improvements are implemented at their production sites.

For both BMW and GM, the EMS is a corporate policy in force by the division of production in the headquarter. The corporate environmental strategies at BMW and GM must be considered as process-oriented policies, even though product orientated initiatives have been implemented (e.g. supply chain management). Therefore, it is limited to what extent their environmental strategies reduce the environmental impact in the whole life cycle of a car. Their 'product-orientation' can be regarded as single initiatives and this is the case for e.g. recycling programmes and product design. In the headquarters the collaboration between environmental departments from different divisions seems limited. As mentioned before, BMW has not implemented LCA in all divisions. Moreover, there has been little integration between the instruments used in different phases, as the case studies showed. This means that the conditions for evolving a product-oriented policy are rudimentary.

Conclusion

In this article, the interplay between process- and product-oriented policies within the car industry has been investigated. Process-oriented policies have been supplemented with product-oriented policies more and more. To what extent these two policies are integrated in the day-to-day practices of car manufacturers will be answered in this section.

On the basis of our empirical studies it can be concluded that the corporate environmental strategies from both BMW and GM are based on a process-oriented strategy that is supplemented with product-oriented initiatives. So far, the initiatives have been implemented as single initiatives and are more or less uncoordinated with other environmental efforts. Globally, both BMW and GM have standards for some environmental issues and EMS, which all production sites have to be in compliance with. These standards determine a baseline for environmental performance that is beyond public environmental regulation in a global perspective.

It is our point of view that a reduction of global environmental loads from the car sector can only be achieved by integrating the process- and product-oriented policies. The challenge for BMW and GM is to strengthen the product focus and combine and integrate the process- and product-orientation into a holistic corporate environmental strategy.

In order to move towards a more product-oriented environmental strategy it is necessary to extend the scope and focus of the corporate environmental policies of the companies. Especially for the car industry, the global production system with changing preconditions and the wide range of stakeholders make it a huge task to implement a product-oriented strategy. More dialogue and collaboration are needed, especially between the production network and the networks of use, recycling and disposal where the contacts currently are limited. BMW and GM could play a more active role by recognising their responsibility for reducing the environmental impacts throughout the product chain and participate more closely in the various phases. It is a challenge for the whole car sector to apply both the process- and product-oriented strategy, as illustrated in figure 5. New types of initiatives are needed.

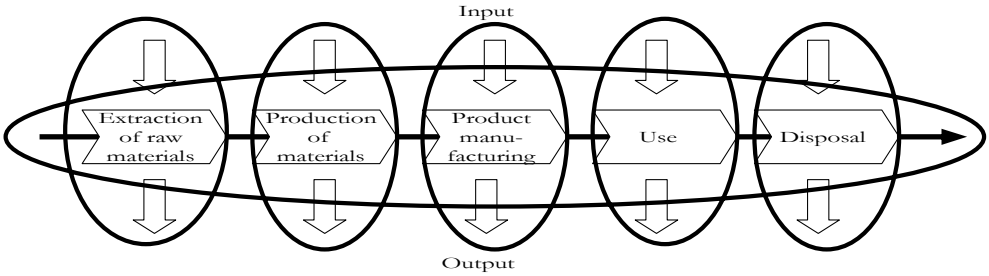


Figure 5. Integration of process- and product-oriented environmental policies.

It can be concluded that BMW and GM have taken product-oriented initiatives but in line with regulation authorities this has so far not been combined and integrated with the process-oriented process. The product-oriented initiatives that so far have been implemented by both authorities and manufactures can potentially be a part of a more integrated process- and product-oriented strategy, which must be initiated and transformed by relevant actors and implemented in all the life cycle phases. To integrate the process- and the product-oriented policies must be a common target for the relevant domains, i.e. state, civil society and industry.

The expected rapid increase in the number of cars the next 15 years (about 75%) enhancing increased mobility, globalisation of trade, creation of wealth etc. will also result in a huge increase in the environmental impact in the whole life cycle of the car. This prognosis asks for a wide range of methods and incentives to reduce the pollution of cars if we are to obtain significant improvements of environmental performance of cars. However, governments do not seem willing to discuss and create more strict and radical regulations to promote new technologies such as cars powered by hydrogen and alternative modes of transportation. This is due to the important economic impacts on society from car production and the use of cars for transportation.

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References

Berkhout, F. 1998. Integrated product policy and industrial competitiveness. In *International Competiveness and Environmental Policies,* Barker, T. and J. Köhler (eds). Cheltenham: Edward Elgar, pp. 241-263.

Berkhout, F. and Smith, D. 1999. Products and the environment: an integrated approach to policy. *European Environment* 9, pp. 174-185.

BMW 2002. 2001-2002 *Sustainability Report. Making a Decision for the Future*. BMW Pretoria, South Africa.

BMW 2003. *Sustainable Value Report 2003/2004. Innovation. Efficiency. Responsibility*. BMW Group.

BMW-web 2004a. BMW plants – where the ultimate machines are made. http://www.bmwworld.com/bmw/plants.htm [26 November 2004]

BMW-web 2004b. BMW Group, manufacturing facilities: the Rosslyn Plant. http://www.bmwgroup.com/e/nav/index.html?http:www.bmwgroup.com/e/0_0_www_bmwgroup_com/9_produktion/9_2_agiles_netzwerk/9_2_1_produktionsnetzwerk/9_2_1_13_montagewerke.shtml [26 November 2004]

Danish Transport Council 2000. Pendling og transportfradrag. Rapport no. 00-04. http://www.trg.dk/transportraadet/pup/RA/RA-00-04.PDF [9 June 2005]

EEA 2002. *Greenhouse gas emission trends and projections in Europe – Are the EU and candidate countries on track to achieve the Kyoto Protocol targets?* European Environment Agency, Copenhagen, Denmark, 2002.

European Commission 2001. *European Transport policy for 2010: Time to Decide*. Directorate-General for Energy and Transport.

Factbook 2005a. Basic indicators. http://www.factbook.net/EGRF_Regional_analyses_AsiaPacific.htm [24 June 2005]

Factbook (2005b), Basic indicators. http://www.factbook.net/EGRF_Regional_analyses_HMCs.htm [24 June 2005]

GM 2003. Corporate Responsibility and Sustainability Report 2001-2002. http://www.gm.com/company/gmability/sustainability/reports/02/home.html [13 May 2003]

GM 2004. Corporate Sustainability Report 2004. http://www.gm.com/company/gmability/sustainability/reports/04/600_environment/index.html [3 May 2005]

GMSA (2005a), Overview of General Motors South Africa – company profile. http://www.gmsa.com/overview.jhtml [24 January 2005]

GMSA 2005b. Key GMSA company facts. Retrieved: http://www.gmsa.com/statistics.jhtml [20 December 2005]

Keijzers, G. 2000. The evolution of Dutch environmental policy: the changing ecological area from 1970-2000 and beyond. *Journal of Cleaner Production*, volume 8 page 179-200.

Ledgerwood, G., Street, E. and Therivel, R. 1992. *The Environmental Audit and Business Strategy. A Total Quality Approach*. Pitman publishing. London

Mildenberger, U. and Khare, A. 2000. Planning for an environment-friendly car. *Technovation*, volume 20 page 205-214.

Mol, A.P.J. and Sonnenfeld, D. 2000. Ecological modernisation around the world: an introduction. *Environmental Politics*, 9, pp. 3-14.

Nadvi, K. and Wältring, F 2002. Making sense of global standards. *INEF Report 58*, Duisburg: Institut für Entwicklung und Frieden, Gerhard-Mercator University.

Nieuwenhuis, P. and Wells, P. 2003. *The death of motoring? Car making and automobility in the 21st century*. Cardiff: Cardiff Business School, University of Wales, John Wiley & Sons.

Remmen, A. 2001. Greening of Danish industry - changes in concepts and policies. *Technology Analysis & Strategic Management*, Volume 13, No. 1, pp. 53-69

Remmen, A 2003. *Cleaner products - new tools, players and relationships. Evaluation of projects carried out under the Danish Environmental Protection Agency's technology action plan 1993-97*. Danish Environmental Protection Agency. Environmental Review No. 7.

Remmen 2005. Integrated product policy in Denmark. New patterns of environmental governance? In *Governance of Integrated Product Policy - meeting the unsustainable production and consumption challenge* Scheer, D. and Rubik, F. (eds.). Sheffield: Greenleaf Publishing Ltd. (forthcoming).

Smink, C.K. 2002. *Modernisation of Environmental Regulations. End-of-Life Vehicle Regulations in the Netherlands and Denmark*. Ph.D.-thesis. Aalborg University, Department of Development and Planning.

Smink, C.K., Jørgensen, T.H. 2005. Experiences with environmental management systems. In *Environmental Planning and Management - tools for sustainable development,* Kørnøv L., Remmen, A., Lund, H. (eds.). Department of Development and Planning, Aalborg University.

Smink, C.K., Nielsen, E.H. and Jørgensen, T.H. 2006. Process and product-oriented environmental policy within the car chain – with examples from BMW and General Motors. In *The Business of Sustainable Mobility* Nieuwenhuis, P. (ed.) Greenleaf Publishing. (forthcoming)

UNEP 2002. *UNEP Report on the automotive industry as a partner for sustainable development*. UNEP's mobility forum.

Wengel, J., Warnke, P. and Lindbom, J. 2003. The future of manufacturing in Europe 2015-2020: the challenge for sustainability. Case study: Automotive industry – personal cars. Institut Systemtechnik und Innovationsforschung.
http://europa.eu.int/comm/research/industrial_technologies/pdf/pro-futman-doc7-casestudy-automotiveindustry-15-4-03.pdf [13 June 2005]